Price discrimination and yield management in the airline industry

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Abstract:

This chapter introduces the concept of price discrimination and explores how a new airline business model enhances the practice of price discrimination in the Australian airline market. Based on the idea of price discrimination, airlines apply yield management to capture high-yield passengers and at the same time to fill the aircraft with price-sensitive passengers to avoid the flight departing with too many empty seats. This history, recent development and approaches of airline yield management are presented in this chapter.

Key words: price discrimination, yield management, airline-within-airline, fare fence, artificial intelligence

1. An introduction to price discrimination

Price discrimination is a business term referring to the charging of different prices to different customers, even though they are purchasing the same product produced with the same marginal cost. The concept of price discrimination was first proposed by the French economist Jules Dupuit in the 1840s, who suggested that some transportation and utility firm can benefit from engaging in the price discrimination strategy. It is believed that a monopoly firm's profit can be enlarged if the market can be segmented to allow the buyers to pay a price close to what that they can afford.

It is well known that a firm's ability to price discriminate depends on three conditions: the possession of a certain degree of market power; the ability to segment the market; the ability to stop the resale of the product or service from one buyer segment to another. The practice of price discrimination is one of causes for price variation in the airline industry. There are three types of price discrimination: first degree, second degree and third degree.

First-degree price discrimination is called perfect price discrimination, which charges each consumer a price equal to the consumer's willingness to pay. Although consumer surplus is completely eliminated under first-degree price discrimination, it is economically efficient and the production is at the point where marginal cost equals marginal benefit. However, in reality, this type of price discrimination is unlikely to happen because a firm usually does not have the ability to determine a consumer's reservation price. Therefore, no airline can practice first-degree price discrimination.

Second-degree price discrimination is the practices of charging consumers difference prices for different quantities a homogeneous product consumed. This type of discrimination allows the firm to take part, but not the entire consumer surplus by offering a few, well defined pricing categories. A frequent flyer program may fall within this type of price discrimination as the points awarded to the passengers can be used later, which is a special kind of discount and consumers do not need to pay for the points at the time of purchasing the ticket.

Third-degree price discrimination refers to the charge of difference prices to different consumer groups such as male and female, children and adults. That is, special discounts are offered to some groups and thus each group pays a different price for consuming the same product or service. This type of price discrimination allows the firm to expand their client base as some consumer groups may not buy the product or service without the discount. Many airline offer corporate travel programs to companies and give cheaper contract prices, which is a practice of third-degree price discrimination.

Third-degree price discrimination is most commonly used by the airline industry. Airlines divide consumers into different groups based a set of characteristics and charge higher prices to those with most inelastic demand. A typical example is to make a distinction between time-sensitive (mainly business travellers) and non time-sensitive passengers (mainly leisure travellers), as well as between point-to-point passengers and connecting passengers. Generally, time-sensitive

travellers prefer faster connections and place a lot of value on flight punctuality and frequency of service. They usually do not book their flights in advance. Their tickets need to be transferable from one flight to another in the event of changes in travel plans at short notice. As their tickets are usually paid for by their company, this group of passengers often buy less restricted tickets at a higher price. In contrast, non-time-sensitive travellers are interested in obtaining the lowest fares, and are willing to accept longer travel times and more restrictions on the use of their tickets, e.g., not refundable, not endorseable, no route and date/flight change, etc. In practice, business passengers can be identified by their inability to book in advance and by buying thickets with fewer restrictions.

Interestingly, some researchers argue that airline pricing falls somewhere between first and second-degree price discrimination because of the use of computer reservation system (CRS). The reason is that although it is impractical to obtain all the potential customers' reservation prices, which makes first-degree impossible, the creation of a large number of prices possible by the CRS allows the airlines to snatch more consumer surplus than second-degree discrimination offers.

Overall, it is generally agreed that price discrimination has helped lower the average fare these days, although it may raise fare for some consumer groups. Compared with the single pricing strategy that may drive some price-sensitive passengers out of the airline market, price discrimination can increase load factors and economic efficiency due to the greater output produced.

2. New business model enhances price discrimination: A case of the Australian airline market

Qantas and Virgin have reported bumper profits in the first half of the 2017-18 financial year. The record profits for Qantas mainly came from the domestic market—Qantas and Jetstar's domestic business recorded the highest ever first half underlying EBIT of $652 million.[1] Virgin Australian also attributes its 142% growth in underlying profits to the strong domestic demand from business and leisure flyers.[2] Strong demand and cost control are two frequently mentioned factors for their

[1]See https://www.qantasnewsroom.com.au/media-releases/qantas-delivers-record-first-half-profit-invests-in-aircraft-and-training/

[2] See https://www.businessinsider.com.au/virgin-australia-has-returned-to-profit-2018-2

success in the domestic market. However, another factor that is less mentioned is the airline-within-airline (AinA) business model adopted by Australian major airlines. This business model is another example that promotes price discrimination in the airline industry.

The AinA strategy was largely a failure in the US and Europe as most low-cost subsidiaries of the full service carriers did not achieve sufficiently low costs to compete against the standalone low-cost carriers. As a result, some US carriers such as American Airlines sought to segment their cabin seating and offer a Basic Economy seating class to those looking for cheaper prices.

Australia's domestic airline market today is a classical duopoly. Qantas has successfully implemented the AinA strategy and used Jetstar as a fighting brand against other low cost carriers in maintaining the group's total domestic market share at around 65% in the last decade. Virgin has also successfully used this model to snatch a substantial share of Qantas' business and corporate passengers in the last few years, and at the same time continued to use Tiger to target the leisure market.

The increasing use of Internet for airline ticket distribution has made it easier for consumers to compare prices across multiple competitors. This has limited the airlines' ability to practice price discrimination. Price discrimination have been a common practice in the airline industry used to transfer consumer surplus to airlines' own profits through charging different prices to different consumer groups based on the knowledge of consumers' willingness to pay.

The AinA strategy has allowed extensive capture of consumer surplus of segmented customer groups to a maximum extent. In August 2017, of Australia's top 144 domestic route markets in terms of passenger traffic volume (each direction of a route is counted as a separate market), Qantas and Jetstar were simultaneously present in 95 markets while Virgin and Tiger in 75 markets. The number of markets where all the four carriers were present was 71.

In fact, the four carriers were simultaneously providing services on most of the heavily travelled and profitable domestic routes where each airline group can exploit consumer surplus of both business and leisure passengers. Consumers in these markets are sufficiently heterogeneous in term

of their travel demand. The AinA model ensures that a variety of products are provided on these routes to meet consumers' demand, which allow the two airline groups to maximise the potential of their revenue.

The capture and transfer of consumer surplus from passengers of each segment to airlines could substantially offset the loss resulting from the price war episodes. In addition, in many cases, price wars are only restricted to the product of a certain market segment. The prices for other segments may have little fluctuations. This is confirmed from the charts of the Domestic Air Fare Indexes published by the Department of Infrastructure, Regional Development and cities, Australian Federal Government, in which we can see that only the best discount fares exhibit wide fluctuations.[3]

Price discrimination can increase total social welfare as it allows more products to be produced to a greater number of consumers, some of whom may otherwise not have access to these products. As long as consumers continue to regard Qantas (and Virgin to a less extent probably) as a premium brand and as long as it can successfully maintain such image, most of them will happily transfer part of their consumer surplus to the carrier as profits.

3. A short history of yield management

Yield management is a pricing strategy that has been adopted by the air transport industry for decades. It is a strategy used to maximize profit by charging the consumer of different demand at a different price. This strategy is popular mainly because airline products, namely, transport services to both passenger and cargo, are perishable, which cannot be stored, saved, returned and resold after the departure of the flight. Yield management helps the carriers to achieve high load factors to ensure high yields.

Yield management related program was first introduced by British Overseas Airways Corporation (BOAC) in the 1960s after the new jet airliner B707s was introduced and resulted in substantial increase in the capacity that the airline could offer. Compared with the aircraft DC-

[3] See https://bitre.gov.au/statistics/aviation/air_fares.aspx.

7C used by BOAC, the payload of B707 was almost five times higher. This led to the launching of the excursion fare discount program known as “Early Bird”. The discount was first offered to passengers travelling between the UK and the Caribbean and later made available on other routes. The “Early Bird” discount came with some conditions. For example, passengers must book their seats three months in advance. They might be required to have a minimum stay of fourteen days at the destination.

Yield management has become popular in the US since the 1980s after the airline industry was deregulated. Throughout the period from the 1940s to the 1970s, the US airline market was controlled and regulated by the Civil Aeronautics Board (CAB), which exercised its authority over entry and exit, pricing, capacity and frequency and so on. The greatest event in the airline industry was the passage in the US of the Airline Deregulation Act (ADA) in 1978. This led to a series of liberalisations in fares, services, and entry and exit to and from this industry across the world (Oum 1998). Carriers were allowed to adjust fares, to service new markets, and to enter or exit as long as they met certain basic requirements.

Following the air deregulation act in 1978, many new airlines entered the market. The intense competitive environment forced airlines to explore new strategies to cope with the market change. For example, People Express Airlines based in New York launched its operation in 1981. The airline adopted the low cost business model and soon became a serious threat to the giant airlines including American Airlines and United Airlines. The newcomer forced both American Airlines and United Airlines matches the People Express Airlines airfare. However, matching fare with the low cost competitors was not a long-term strategy given the different cost structure between the full service and low cost airlines. To obtain a balance between price and payload, American Airlines developed a yield management system to compete with other carriers with the aid of CRS.

Airline distribution has for many years been synonymous with the Computer Reservation System (CRS), later termed the Global Distribution System (GDS). The GDS provides virtual real-time connectivity between thousands of suppliers of travel inventory (airlines, hotels, car rental, tour operators, cruise lines etc.) and hundreds of thousands of retail sellers of travel products. The system has significantly improved airlines efficiency in attracting and retaining custom and driving sales through travel agents. These gave American Airlines numerous consumer behavior

data, which allowed the airline to develop a sophisticated yield management program to attract both the high yield and low yield passengers. In contrast, those airlines operating with low cost model with simple single fare structure were unable to react to this strategy. As a results, some of some of the small and low-cost airlines were driven out of business. Other airlines followed suit and applied the yield management strategy.

4. Conditions for the application of Yield Management

Yield management is a technique used by many industries, particularly in those with capacity constrain. The objective of applying yield management is to maximize the revenue with limited resources. Air transport companies use yield management to increase their revenue for each flight by predicting the travel demand of different travelers segments between origin and destination and charge each segment with an optimal price. Airline products have the following characteristics that make them most suitable for the application of yield management: each aircraft has fixed capacity; the products are perishable and cannot be stored for the next flight; the passenger groups can be segmented into different sub-groups that allow airlines charge different prices accordingly; passenger demand is subject to frequent fluctuations; the products can be sold in advance; the marginal cost is relatively low compared with the fixed cost.

Successfully applying the yield management technique is not an easy task. Airlines are required to divide the customers into smaller segments and offer them the most suitable and wanted products. Given that contemporary business environment changes frequently and rapidly, airlines need to collect customers' purchasing behavior data, based on which the airline can monitor the market, change the fare and control the seat inventory. The objective is to ensure that not all seats are sold at a low price to reduce the airline revenue, while at the same time the seats are not sold at an expensive price that steer passengers away to the competitors, leading to aircraft departing with empty seats. An effective application of yield management requires the following conditions: an effective constraints that prohibit high yield passengers to buy low fares; a mechanism to allocate seats to maximize revenue in the face of demand fluctuations; and a reliable prediction of demand, no-shows, overbooking, etc.

To ensure that the right price is charged based on the customers' demand, airlines have created multiple booking codes in a cabin class. To differentiate each booking code, different restrictions

are set to prevent the high yield customers from buying low fares. In general, the lower fare class, the more limitations. Common restrictions (also called fences) include:

- Advance purchase requirement
- Restrictions on earning frequent flyer points
- Restrictions on departure days and times
- Round-trip requirement
- Minimum and maximum stays
- Flight change and refund penalties

5. Yield management methods

To maximize the profit, an airline needs to identify the amount of inventory available at each fare bucket. Fare buckets are closely connected, known as serial nesting. When a seat was sold from one fare bucket, the amount of inventory remaining in other buckets may be effected. For example, when a seat in the higher fare bucket was sold, a seat from the lower fare bucket will be reduced. Therefore, the key of airline yield management is about the seat inventory control. That is, optimally allocating the fixed number of seats to the demand before a flight departs.

The leg based yield management system was common in the airline industry. In single leg seat inventory control, the booking system evaluates a booking request by one segment of flight without considering the complete itinerary of the travelers. In other words, the system shows the same availability to all travelers regardless of a single leg journey or multiple leg in the passengers 'itinerary.

Following air transport liberalization, many airlines have adopted the hub-and-spoke system. Today, the majority of travelers' itinerary consists of multiple flights, as most routing required the travelers to transit at a hub airport. This is facilitated by the proliferation of airline alliances and code-share agreements, which have increased the complexity of the traditional yield management system. Network seat inventory control is thus called for and an airline's network is optimized simultaneously.

The Origin and destination (O&D) yield management system provides a solution for network seat inventory control to the carriers when itineraries involve connecting and code-sharing flight

legs. The O&D yield management forecast the travel volume by city pair based on the passengers' complete itinerary including the inbound and outbound connections, which allows the airline to obtain accurate demand data and implement the right pricing strategies. Various mathematical programming models have been developed to realize the network seat inventory control.

Upgrade bidding and airport upsell have become useful yield management tools for some airlines to maximize profits. This strategy is useful to resolve problems when there are forecast errors between supply and demand. The airline offers passengers in the lower cabin to entering an auction exercise for upgrading to premium seating by additional payment. The customers are free to offer their bidding price. Closer to the departure date, when premium seats are still available, the airlines will issue the upgrade confirmation to those passengers who offer the highest bid. Airport upsell is another strategy similar to the upgrade-bidding program. Some airlines offer upsell deal to passengers to upgrade to higher service cabin on the departure day with a charge at the airport check-in counter.[4] These strategies allowed the airline to earn additional last minute earning to further maximize their profits.

6. Big data analytics, artificial intelligence and yield management

Traditional yield management adopted by airlines for decades relied on the historical data collected by the CRS. Modern technology has changed the shape of yield management, which allows airlines to gather data before customers purchase tickets. Big data and artificial intelligence are two technologies that are closely linked and can revolutionize the traditional yield management system. Big data refer to the raw data or inputs that are uncleansed and unstructured while artificial intelligence is the output and actions taken to resolve the issues. The development of artificial intelligence into yield management system gives the airlines a large volume of useful data of customer demand, which makes it possible for the airlines to offer a fare that is closer to the customers' demand. The big-data based artificial intelligence system collects data from the passenger's flight search history over the internet to examine the demand of flights. Based on the customers' browsing pattern, the artificial intelligence system tracks the changing volume of search requests from the airline website or other search engines. The artificial

[4] https://atwonline.com/blog/airlines-need-master-art-upsell

intelligence allows the airlines to make prompt changes to the airfare if needed. In particular, the artificial intelligence system generates customer-centric offers and develops personalized pricing strategies to meet the needs of consumers.[5] The new technology is the key for the modern era airlines to maximize profits and succeed in the rapidly changing business environment.

Further readings

Belobaba, P. P., & Wilson , J. L. (1997). Impacts of yield management in competitive airline markets. Journal of Air Transport Management, 3(1),3-9.

Carrier, E., & Fiig, T. (2018). Future of Airline Revenue Management. Journal of Revenue & Pricing Management, 17(2) 45-47.

Cole, S. (2005). Applied Transport Economics: Policy Management and Decision Making. London: Kogan Page.

Cross, R. G. (1997). Revenue Management: Hard-Core Tactics for Market Domination. New York: Broadway Books.

Donaghy, K., McMahon, U., & McDowell , D. (1995). Yield Management: an overview. International Journal of Hospitality Management, 14(2), 139-150.

Pak, K., & Piersma, N. N. (2002). Airline revenue management: An overview of OR techniques 1982-2001 (No. EI 2002-03).

Skugge, G. (2002). Implementing Airline Origin and Destination Revenue Management System. Journal of Revenue & Pricing Management, 1(3), 255-266.

Vasigh, B., Fleming, K., & Tacker, T. (2017). Introduction to Air Transport Economics: From Theory to Application. UK: Routledge.

Wang, X. L., Yoonjoung Heo, C., Schwartz, Z., Legohérel, P., & Specklin, F. (2015). Revenue management: Progress, challenges, and research prospects. Journal of Travel & Tourism Marketing, 32(7), 797-811.

[5] https://www.triometric.net/the-ai-opportunity-in-revenue-management/

Wensveen, J. G. (2015). Air Transportation: A Management Perspective. New York: Routledge.